【課後評量】

2. 請問下列程式區段的迴圈部份,實際執行次數與時間複雜度。

for i in rnage(1,n+1):

for j in range(i,n+1):

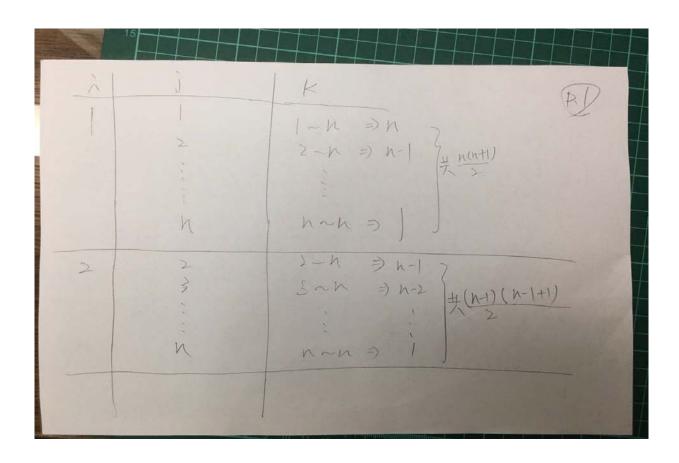
for k in range(j,n+1):

解答:我們可利用數學式來計算,公式如下:

$$\begin{split} & \sum_{i=1}^{n} \quad \sum_{j=i}^{n} \sum_{k=j}^{n} 1 = \sum_{i=1}^{n} \sum_{j=i}^{n} (n-j+1) \\ & = \sum_{i=1}^{n} \left(\sum_{j=i}^{n} n - \sum_{j=i}^{n} j + \sum_{j=i}^{n} 1 \right) \\ & = \sum_{i=1}^{n} \left(\frac{2n(n-i+1)}{2} - \frac{(n+i)(n-i+1)}{2} + (n-i+1) \right) \\ & = \sum_{i=1}^{n} \left(\frac{(n-i+1)}{2} \right) (n-i+2) \\ & = \frac{1}{2} \sum_{i=1}^{n} (n^2 + 3n + 2 + i^2 - 2ni - 3i) \\ & = \frac{1}{2} (n^3 + 3n^2 + 2n + \frac{n(n+1)(2n+1)}{6} - n^3 - n^2 - \frac{3n^2 + 3n}{2} \right) \\ & = \frac{1}{2} \left(\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2} \right) \\ & = \frac{n(n+1)(n+2)}{6} \end{split}$$

這個 $\frac{n(n+1)(n+2)}{6}$ 就是實際迴圈執行次數,且我們知道必定存在 c ,

 $\frac{\mathbf{n}_{(n+1)(n+2)}}{\mathbf{n}_{0}}$ \mathbf{n}_{0} 使得 \leq \mathbf{c} \mathbf{n}^{3} ,當 \mathbf{n} \geq \mathbf{n}_{0} 時間複雜度為 \mathbf{n} \mathbf{n}



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	$\tilde{h}=1$ \Rightarrow $\frac{h(h+1)}{2}$ $\tilde{h}=2$ \Rightarrow $\frac{h-l(h+1)}{2}$		(n-x+1) ((h-x+1)+1))
	1= N-1=) = = = = = = = = = = = = = = = = = =	241) =	$\frac{n}{2} \frac{(n-\lambda+1)(n-\lambda+2)}{2}$
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4.求下列片段程式中,函數 my_fun(i,j,k)的執行次數:

```
for k in range(1,n+1):

for i in range(0,k):

if i!=j:

my_fun(i,j,k)
```

解答: n*(n+1)*(2n+1)/6-n*(n+1)/2=n²(n+1)/3

5.請問以下程式的 Big-O 為何?

```
total=0
for i in range(1,n+1):
total=total+i*i
```

解答:迴圈執行 n 次,所以是 O(n)

9.請寫一個演算法來求取函數 f(n),f(n)的定義如下:

```
f(n): \left\{ \begin{array}{cc} & n^n & \quad \text{if } n\!\geq\!1 \\ \\ & \end{array} \right.
```

1 otherwise

答:

```
def aaa(n):
    if n<=0:
        return 1
    p=n
    q=n-1
    while q>0:
        p=p*n
    q=q-1
```